UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101-3140

June 30, 2008

Reply To: ECL-117

MEMORANDUM

SUBJECT: EPA Region 10 Responses to National Remedy Review Board Recommendations for the Hanford 200-ZP-1 Superfund Site

FROM: Daniel D. Opalski, Director
Office of Environmental Cleanup
U.S. EPA Region 10

TO: David E. Cooper, Chair
National Remedy Review Board

Attached please find EPA Region 10 responses to the Remedy Review Board recommendations for the cleanup of the Hanford 200-ZP-1 Superfund Site.

The Region appreciates the thoughtful comments of the Board. If you have any questions, please contact Dennis Faulk.

Attachment

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

April 11, 2008

NRRB Advisory Recommendations

1. In the package presented to the Board, the time and cost estimates, as well as the cost and effectiveness analysis for the pump and treat system, were based on a very simplistic model. The Board recommends that DOE conduct a more robust modeling analysis to better understand remediation timeframes. Current restoration timeframe estimates seem overly optimistic. The Board believes that additional information is needed to better understand the restoration timeframes. In addition, the Board recommends that the decision documents should be clear that the remediation goals are numerical standards such as MCLs or risk-based concentrations rather than a specific mass removal. The Board is encouraged that DOE is pursuing a restoration remedy at this site. However, the package presented to the Board did not provide data to determine whether either proposed extraction rate could achieve cleanup goals during the predicted timeframes. The Board recommends that the preferred alternative be more fully evaluated to determine whether it could achieve cleanup goals within the targeted timeframes under the extraction rates proposed.

Response: The Region understands the Board's concern. DOE's assessment, developed during the course of the RI/FS and informed by several years of vapor extraction and groundwater remediation efforts, is a best estimate of restoration timeframes based on current information. We recognize that there is inherent uncertainty in any projection of aquifer restoration timeframes and appreciate the Board's comment that recognizes DOE's commitment to restoring the aquifer to beneficial uses. It is our expectation that refining restoration timeframe estimates will be an ongoing process during both remedial design and subsequent system operations. Five-year reviews will also provide an opportunity to evaluate the progress of the selected remedy in achieving remedial action objectives. The Proposed Plan has been modified to include a table listing the numerical cleanup criteria for each contaminant of concern.

2. The remedy preferred by DOE included a ground water extraction and treatment system to address ground water contamination. The preferred remedy included two ground water extraction rates; however, no clear rationale was presented for how a final flow rate decision would be made between the two. The two options were for ground water extraction at 840 gallons per minute (GPM) and 1615 GPM with associated present worth costs of $93 M and $180 M, respectively. The stated benefit of the larger system is to reduce the time to achieve cleanup goals from about 50 years to 25 years. Based on information presented to it, the Board was not clear which pumping rate should be considered the preferred alternative. Because the radiological contamination at this site will require long-term management of wastes and ground water use restrictions, the board questions the need for the more rapid ground water cleanup and

the additional costs of the larger system. DOE can use the results of the more robust modeling recommended in comment 1 to evaluate whether the higher pumping rate is cost effective. The board recommends that DOE clearly select a ground water extraction rate, and the associated system capacity, and provide the rationale in the decision documents.

Response: The Agencies have selected the more aggressive pumping rate of 1600 GPM as the preferred alternative to be presented in the proposed plan. The 800 GPM system is the minimum required to contain/treat the 100 ug/liter and greater plume. The rationale for the higher pumping rate is that the Agencies are committed to restoring the aquifer as soon as possible. The difference in the capital cost for the larger system is relatively minor, and the increased cost of money over time (inflation) makes investing in the larger system a better return on the dollar. See response to #1 regarding additional modeling related timeframes.

3. The preferred remedial alternative assumes that DNAPL is not present in the saturated zone and is not present in significant quantities, if at all, in the vadose zone. However, carbon tetrachloride concentrations and spatial distribution data presented to the Board (taken from annual ground water monitoring reports) suggest that DNAPL source zones may exist in the subsurface. The preferred alternative includes a contingency to address DNAPL material in the saturated and vadose zone, if found. The two options presented to the Board were electric heating and biological treatment. The cost for the heating option is $175M compared to $25 M for anaerobic biodegradation. Because DOE has not been able to identify or delineate DNAPL in the subsurface, has not fully developed alternatives to address possible DNAPL nor evaluated the potential effectiveness of those alternatives, nor described criteria for invoking the contingency, the Board recommends that the contingencies should not be included in the decision documents until these issues have been further evaluated.

Response: An extensive effort was undertaken to look for DNAPL in the subsurface. During the investigation, one area in the vadose zone had DNAPL present. The conceptual model is that DNAPL may exist in small fingers/globules in the areas of high silt in the vadose zone. In the groundwater we believe the contamination is of a dissolved nature placed there by years of high volume liquid discharge. The Region agrees with the comment regarding the contingent remedies, and they have been removed from the proposed plan.

4. The preferred alternative includes reinjection of treated ground water to control plume migration and speed up ground water restoration. However, in the package presented to the Board, it appears that extracted ground water would not be treated for all contaminants (e.g., tritium, iodine 129) before reinjection. In addition, the Board is concerned that some of the water reinjected up gradient of the capture system would not be captured by down gradient capture wells. The Board recommends that the Region review the reinjection strategy, which should be discussed in the decision documents, along with targets developed for reinjected ground water.

Response: The reinjection strategy will be further developed in remedial design. Wells that have tritium, iodine 129, and nitrate will be reinjected in a manner such that they are re-circulated in the capture zone. The ROD will specify reinjection standards for all COCs.

5. The goal of the pump and treat system for the Hanford 200-ZP-1 OU is to capture the contaminant plume and restore water quality within the plume boundaries. Because of the large lateral and vertical extent of the plume, the complexity of the subsurface geology, and the contaminant source distribution, the monitoring system design will be critical to evaluating the performance of the pump and treat system, as well as ensuring plume containment and clean-up of contaminated ground water. The Board recommends that DOE develop an appropriate strategy to monitor water quality and hydraulic heads during the remedy design phase. EPA guidance on capture zone analysis (see U.S. EPA, 2008, "A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems," EPA/600/R-08/003) should be consulted during development of the monitoring plan.

Response: The Region agrees, and the monitoring plan that is currently in place for the interim action will be updated as the capture zone is expanded. Also, the above-cited guidance will be reviewed as part of this effort.

6. As presented to the board, monitored natural attenuation (MNA) is proposed as a remedial alternative to treat the ground water contamination in the distal portion of the plume for carbon tetrachloride for the Hanford 200-ZP-1 OU. Organic contaminants (e.g., carbon tetrachloride) as well as radionuclides are present in the ground water and vadose zone at high concentrations. Given the complexity of the site and the presence of multiple contaminants (organic and inorganic, radionuclides, transformation products and radionuclide decay daughters) and the variation in the site's hydrologic conditions as well as geochemical conditions, and reinjection of treated ground water, natural attenuation processes will be very complex and the rates of attenuation will be contaminant specific. Based on the information provided in the package, the Board believes that MNA has not been evaluated to the degree necessary to consider it an appropriate remedy for the site.

The Board recommends that decision documents provide supporting evidence for natural attenuation (e.g., site-specific attenuation mechanisms) and should provide estimates for attenuation rates and timeframes for achieving ground water cleanup criteria consistent with Agency guidance on MNA. (see e.g., "Use Of Monitored Natural Attenuation At Superfund, RCRA Corrective Action, And Underground Storage Tank Sites," OSWER Directive 9200.4-17P April 21, 1999; "Monitored Natural Attenuation of Inorganic Contaminants in Ground Water Volume 1 - Technical Basis for Assessments," EPA/600/R-07/139 October 2007; "Monitored Natural Attenuation of Inorganic Contaminants in Ground Water Volume 2 - Assessment for Non-Radionuclides Including Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Nitrate, Perchlorate, and Selenium," EPA/600/R-07/140 October 2007). The decision documents should identify mechanisms of natural attenuation for all contaminants for which MNA is being selected. These mechanisms, which may be different under different conditions,

should be identified for the range of hydrologic and geochemical settings encountered at the site. This information includes determining the organic transformation products, radionuclide isotopes and daughters, identifying the immobilization processes and rates that may be present or become present in both the vadose and ground water environments.

Furthermore, MNA is not appropriate for contaminate plumes that are not stable or are expanding (see "Use Of Monitored Natural Attenuation At Superfund, RCRA Corrective Action, And Underground Storage Tank Sites," OSWER Directive 9200.4-17P April 21, 1999, p. 17) and the package presented to the Board indicated that this plume is not stable. Therefore, even if MNA is supported by the above evaluation, it should only be proposed for portions of the plume which are shrinking or stable. Alternatively, the Board recommends evaluating whether a shorter remediation timeframe could be achieved by capturing the lesser concentrated portions of the plume with minimal additional cost.

Response: The Region believes the distal portions of the plume are good candidates for MNA. The extensive characterization completed as part of the remedial investigation process showed the contamination is more widespread than originally thought. However, the carbon tetrachloride plume is considered to be relatively stable since liquid discharges ceased nearly 20 years ago and ongoing vapor extraction in the vadose zone is preventing the movement of carbon tetrachloride into the groundwater. Abiotic hydrolysis of carbon tetrachloride occurs under aerobic conditions and is expected to occur in the predominately aerobic 200-ZP-1 aquifer in a timeframe of about 100 years to meet the proposed cleanup levels. Anaerobic degradation could also occur in localized portions of the aquifer. The process of MNA is expected to reduce concentrations of tritium (half-life of 12.3 years) by radioactive decay within the estimated MNA timeframe for carbon tetrachloride. The estimated MNA timeframe is in line with discussions held with members of our site advisory board and other stakeholders as part of Hanford End-State workshops. The resulting outcome of the workshop was that the Hanford cleanup will take approximately 50 years to complete followed by an assumption that active institutional controls would be in place for 100 years post closure. Therefore, it is appropriate for the 200-ZP-1 OU to assume that federal control with institutional controls will be in place until the year 2150 to prevent the use of groundwater until cleanup levels have been achieved.

Factors used to determine if MNA was viable include the following:

- **Factor 1. MNA can effectively remediate organic groundwater contaminants such as carbon tetrachloride by both biological and non-biological (abiotic) processes. Biological degradation products of carbon tetrachloride (chloroform and methylene chloride) are present in the 200-ZP-1 OU. However, due to the high degree of variability of the rates of biological degradation and to ensure conservatism in the remedy analysis, biological degradation was not considered a natural attenuation mechanism for carbon tetrachloride in the estimates of natural attenuation for the 200-ZP-1 remedy development. Abiotic degradation of carbon tetrachloride occurs with no hazardous products and was considered a dependable natural attenuation**

mechanism. Abiotic degradation rate data are available in the literature, and additional studies are underway to refine the rate information under site-specific conditions.

- **Factor 2. MNA is most effective in lower concentration zones with no continuing source of contamination. The active pump-and-treat system will remove approximately 95% of the carbon tetrachloride mass, so MNA can be most effective for the residual carbon tetrachloride located in the distal part of the plume.**
- **Factor 3. Analytical modeling using conservative values for site-specific MNA processes indicates that MNA can remediate the lower-concentration carbon tetrachloride plume area within a reasonable timeframe (approximately 100 years). The modeling also indicates that this portion of the plume area will remain on the Central Plateau during this timeframe, which is a significant distance from any potential human and ecological receptors.**

7. The Board did not have sufficient information to evaluate the role of Washington Model Toxics Control Act (MTCA) at this site and whether MTCA Method B is an ARAR at this site. However, it may be appropriate to use it as a "to-be-considered" guidance (TBC) in developing soil cleanup levels. To the extent MTCA might be considered as an ARAR, the Board notes that the stringent cleanup levels identified by the state may not be achievable with current technology. The Board recommends that the Region, DOE, and the state work together in evaluating the appropriate role of MTCA in designing a remedial action that will protect human health and the environment.

Response: The Region, State, and DOE have agreed to use the MTCA method B for cleanup of carbon tetrachloride. The method B number is 3.4 ug/liter as compared to 5 ug/liter for the federal MCL and should be achievable with current technology.

8. The package presented to the Board included a remedial action objective (RAO) to prevent or mitigate risks in ground water where concentrations exceed ARARs or a $1x10^{-4}$ cancer risk level. The Board notes that this approach is inconsistent with the NCP's point of departure of 10^{-6} (see 40 CFR §300.430(e)(2)(i)(A)(2)). While a remedial action can be selected that does not meet the point of departure (see 55 FR 8718, March 8, 1990), the rationale for doing so should be described in the site decision documents. In particular, the NCP preamble states: "Preliminary remediation goals for carcinogens are set at a 10^{-6} excess cancer risk as a point of departure, but may be revised to a different risk level within the acceptable risk range based on the consideration of appropriate factors including, but not limited to: exposure factors, uncertainty factors, and technical factors" (see 55 FR 8717, March 8, 1990). Furthermore, the decision documents need to be clear whether the cleanup is based on a risk based number or an ARAR. Risk based radionuclide cleanup levels may be developed using Agency guidance (e.g., electronic calculator entitled: "Radionuclide Preliminary Remediation Goals (PRGs) for Superfund" (http://epa-prgs.ornl.gov/radionuclides/)).

Response: The Region agrees, and the language on point of departure has been changed. As stated earlier, the cleanup levels are ARAR-based using either the federal MCL or the State MTCA level.

9. The package presented to the Board indicates that five-year reviews will stop when the $1x10^{-4}$ cancer risk level based on industrial risk is met. The Board notes that this is inconsistent with the NCP. Pursuant to CERCLA and the NCP, a five-year review is required whenever a selected remedy leaves hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure. Exposures associated with industrial land use are not considered unlimited nor unrestricted and such sites typically would be under some form of institutional control (see "Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups," OSWER Directive 9355.0-74FS-P, September 2000).

Response: The Region agrees, and this language has been removed. See response to last comment.

10. The package presented to the board includes an RAO to "prevent or mitigate occupational health risks to workers performing remedial action." While the Board believes that worker health and safety is extremely important, the Board notes that this issue seems to have been incorrectly identified an RAO. RAOs specify contaminants and media of concern, potential exposure pathways and remediation goals (i.e., acceptable exposure levels that are protective of human health and the environment: see 40 CFR §300.430(e)(2)(I)), but do not typically specify how those goals are met. Worker safety may be addressed under short-term effectiveness as part of the nine criteria analysis, where "potential impacts on workers during remedial action and the effectiveness and reliability of protective measures" is explicitly considered (40 CFR §300.430(e)(9)(iii)(E)). Including this as an RAO may give the mistaken impression that prevention of any worker risks is similar to a threshold criterion, and result in arguments for remedial alternatives that do not take any active remediation since these will generally have some inherent worker risk.

Response: Agreed. This RAO has been removed and will be considered as part of the 9 criteria evaluation.

11. The Board was not presented much information on Tc-99, a radioactive contaminant in the vadose zone and ground water. In particular, the extent of Tc-99 in vadose zone is unclear. In addition, the Board was not presented information as to the specific oxidation state of the Tc-99, which can influence mobility of the contaminant in the vadose zone. The preferred alternative is premised on the belief that the Tc-99 in vadose zone will be captured by this ground water pump and treat system. The Board recommends that DOE further characterize Tc-99 in the vadose zone and minimize the amount of Tc-99 that gets to the groundwater. The Board recognizes that EPA is working with DOE on treatability studies to address the vadose zone Tc-99 and encourages this effort. Redox chemistry issues are also likely to be important for

other elements, such as chromium and uranium and other contaminants that can exist in different oxidized states.

Response: The Region agrees that dealing with the Tc-99 in the vadose zone will be an important component to the long-term restoration of the aquifer. Treatability tests for Tc-99 in the vadose zone are ongoing at this time. It should be noted that soil contamination is being addressed under source operable units, and this cleanup focuses only on the groundwater.

12. The proposed plan is intended to be a final remedy for the ground water in the 200 West Area. However, according to the package presented to the Board, the presence of contaminant sources, particularly of Tc-99, in the vadose zone is not well characterized. Consequently, the Region is uncertain about the quantity and extent of source material remaining in the vadose zone and its contribution to ground water contamination. The Board notes that the amount of source remaining in the vadose zone could affect the duration required to pump and treat ground water contamination. Following the further investigations recommended in comment 11, DOE will better understand the impacts of the remaining sources of Tc-99 in vadose.

Response: Agreed. See response to 11.